

CLAIMS

1. A thin layer capacitor element comprising a capacitor with a dielectric layer made of a metal oxide and at least one protective insulating layer made of a cured resin, in which a barrier layer comprising a non-conductive inorganic material is provided between the capacitor and the protective insulating layer.
2. A thin layer capacitor element comprising a substrate having formed thereon a capacitor with a dielectric layer made of a metal oxide, in which a barrier layer comprising a non-conductive inorganic material is covering at least the top and side of the capacitor, and at least one protective insulating layer made of a cured resin is formed on the barrier layer.
3. A thin layer capacitor element as described in Claim 1 or 2, in which the barrier layer is a material having the same thermal expansion coefficient as that of the dielectric layer.
4. A thin layer capacitor element as described in Claim 1 or 2, in which the barrier layer has the same composition as that of the dielectric layer.
5. A thin layer capacitor element as described in Claim 1 or 2, in which the barrier layer is aluminum oxide, silicon oxide or silicon nitride.
6. A thin layer capacitor element as described in Claim 1 or 2, in which the barrier layer is amorphous.
7. A thin layer capacitor element as described in Claim 1 or 2, in which the dielectric layer comprises a composite metal oxide comprising at least one metal selected from strontium (Sr), barium (Ba), lead (Pb), zinc (Zr), bismuth (Bi), tantalum (Ta), titanium (Ti), magnesium (Mg) and niobium (Nb).
8. A thin layer capacitor element as described in Claim 1 or 2, which further comprises the terminals for external electrical connection provided at least at a location other than the edge of one side of the package.

9. A thin layer capacitor as described in Claim 1 or 2, in which a plurality of capacitors with different capacitances are provided in one thin layer capacitor element.

5 10. A thin layer capacitor as described in Claim 2, in which the capacitor is formed on the substrate via an adhesion layer having the same material composition as that of the barrier layer.

10 11. A thin layer capacitor as described in Claim 10, in which the adhesion layer and barrier layer each comprises a material which contains alumina or  $\text{TiO}_x$  as a main component thereof.

15 12. A thin layer capacitor element comprising a substrate having formed thereon a capacitor, in which the top of the capacitor structure is covered with at least one protective insulating layer made of a cured resin, formed upon curing from at least one resin precursor selected from the group consisting of thermosetting resins, photosetting resins and thermoplastic resins.

20 13. A thin layer capacitor element as described in Claim 12, in which the amount of moisture discharged from the resin precursor upon curing of the resin precursor is not more than 0.01 wt% of the resin precursor.

25 14. A thin layer capacitor element as described in Claim 12 or 13, in which the cured resin is at least one resin selected from the group consisting of epoxy resins, bismaleimide/triazine (BT) resins, polytetrafluoroethylene (PTFE) resins, benzocyclobutene (BCB) resins, acrylic resins and diallyl phthalate  
30 resins.

15 15. A thin layer capacitor element as described in Claim 12 or 13, in which the protective insulating layer has a multilayer structure.

35 16. A thin layer capacitor element as described in Claim 12 or 13, in which the protective insulating layer directly covers the capacitor.

17. A thin layer capacitor element as described in

Claim 12 or 13, in which the dielectric layer comprises a composite metal oxide comprising at least one metal selected from the group consisting of Sr, Ba, Pb, Zr, Bi, Ta, Ti, Mg and Nb.

5           18. A thin layer capacitor element as described in Claim 12 or 13, in which a plurality of capacitors with different capacitances are provided in one thin layer capacitor element.

10           19. A thin layer capacitor element as described in Claim 12 or 13, which further comprises an adhesion layer between the substrate and the capacitor.

15           20. A thin layer capacitor element as described in Claim 19, in which the adhesion layer comprises at least one material selected from the group consisting of precious metals, precious metal alloys, alloys of precious metal and non-precious metal, conductive oxides of precious metals, insulating metal oxides, insulating metal nitrides, conductive metal nitrides and their combinations or mixtures.

20           21. A thin layer capacitor element as described in Claim 2 or 12, in which the substrate comprises an electrically insulating material selected from the group consisting of glass, semiconductor materials and resin materials.

25           22. A thin layer capacitor element as described in Claim 1, 2 or 12, in which the capacitor comprises a capacitor structure constituted from the dielectric layer sandwiched between a lower electrode layer and an upper electrode layer.

30           23. A thin layer capacitor element as described in Claim 22, in which the lower electrode layer comprises at least one material selected from the group consisting of transition metals, precious metals, precious metal alloys, alloys of precious metal and non-precious metal, conductive oxides, and their combinations or mixtures.

35           24. A thin layer capacitor element as described in Claim 22, in which the upper electrode layer comprises at

least one material selected from the group consisting of transition metals, precious metals, precious metal alloys, alloys of precious metal and non-precious metal, conductive oxides, and their combinations or mixtures.

5           25. A thin layer capacitor element as described in Claim 22, which further comprises a passivation film on the upper electrode layer.

26. A process for production of a thin layer capacitor element comprising a capacitor with a  
10           dielectric layer made of a metal oxide and at least one protective insulating layer made of a cured resin, which comprises the steps of:

                  forming a capacitor;  
                  forming a barrier layer, from a non-  
15           conductive inorganic material, on the capacitor; and  
                  forming at least one protective insulating layer on the barrier layer so that the capacitor and the protective insulating layer is separated from the barrier layer.

20           27. A process for production of a thin layer capacitor element comprising the steps of:

                  forming a capacitor with a dielectric layer, from a metal oxide, on a substrate;  
                  forming a barrier layer, from a non-  
25           conductive inorganic material, to cover at least the top and side of the capacitor; and  
                  forming at least one protective insulating layer, from a cured resin, on the barrier layer so that the capacitor and the protective insulating layer is  
30           separated from the barrier layer.

28. A process for production of a thin layer capacitor as described in Claim 26 or 27, which further comprises the step of forming the dielectric layer by a sputtering method.

35           29. A process for production of a thin layer capacitor element as described in Claim 27, which further comprises a step of forming an adhesion layer, from a

material which contains alumina or BST as a main component thereof, on the substrate, wherein the adhesion layer is formed in an amorphous state.

5       30. A process for production of a thin layer capacitor element as described in Claim 27, which further comprises a step of forming an adhesion layer composed mainly of  $TiO_x$  on the substrate at room temperature.

      31. A process for production of a thin layer capacitor element comprising a substrate having formed thereon a capacitor, which comprises the steps of:  
              forming a capacitor on a substrate;  
              applying at least one resin precursor selected from the group consisting of thermosetting resins, photosetting resins and thermoplastic resins on  
15       the capacitor; and  
              curing the resin precursor to form at least one protective insulating layer.

      32. A process for production of a thin layer capacitor element as described in Claim 31, in which  
20       during curing of the resin precursor, the amount of moisture discharged from the resin precursor upon curing is limited to not more than 0.01 wt% of the resin precursor.

      33. A process for production of a thin layer capacitor element as described in Claim 31 or 32, in  
25       which the protective insulating layer is formed from at least one cured resin selected from the group consisting of epoxy resins, bismaleimide/triazine (BT) resins, polytetrafluoroethylene (PTFE) resins, benzocyclobutene (BCB) resins, acrylic resins and diallyl phthalate  
30       resins.

      34. A process for production of a thin layer capacitor element as described in Claim 31 or 32, in  
      which the protective insulating layer is formed directly  
35       on the capacitor.

      35. A process for production of a thin layer capacitor element as described in Claim 31 or 32, which

further comprises a step of forming an adhesion layer between the substrate and the capacitor.

5       36. An electronic device which comprises at least one electronic element and at least one thin layer capacitor element as described in any one of Claims 1 to 25.

10       37. An electronic device as described in Claim 36, in which the electronic element is selected from the group consisting of conventional type capacitors, resistors, inductors, semiconductor elements, wiring layers and electrode layers.